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(19) (CA) **CANADIAN PATENT** (12)

(54) FLYING SAUCER AMUSEMENT DEVICE

(72) Firestone, Bruce M.;
Weidmark, Christopher J.,
Canada

(73) Granted to Istari Electronics, Inc.
Canada

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ABSTRACT OF THE DISCLOSURE

A flying-saucer (flying disc) amusement device which is thrown by hand having greater stability and range than prior known devices. The device achieves superior performance by the addition of "pimple" shaped or other shaped discrete spoilers on the upper surface of the flying saucer which creates a thin layer of turbulent air over the entire upper surface of the flying disc reducing aerodynamic drag. The raised spoilers are arranged in annular rings which may cover part or all of the upper surface of the flying saucer. The annular rings can be placed at varying intervals. Each interval defines an "equator" which provides additional flight stability, helps to prevent "slicing" of the throw and also improves the range of the device. When one or more annular rings of discrete, raised spoilers are placed at or near the periphery of the device (but not at or near the centre of the device), the discrete, raised spoilers add a small additional weight to the device which serves to disproportionately increase its angular momentum and, hence, its range.

This invention is related to flying saucers or flying discs of the amusement type and commonly referred to under the name "FRISBEE" (Trademark).

Prior known devices of the class are typified by a number of patents which may be summarized as follows. United States Patent 3,828,466, issued August 13, 1974, entitled "Flying Saucer" which discloses a flying saucer which shows concave dimples on the lower surface of the interior to provide "a good hand grip". Molding of these dimples creates corresponding pimples on the upper surface of the saucer, but such are not provided for aerodynamic purposes and no such effect is mentioned. The dimples could of course, be formed without any pimpling on the upper surface.

United States Patent 3,939,602, issued February 24, 1976, entitled "Circular Air Glider" discloses a flying saucer having radial ribs and passage for air flow from the lower to upper surfaces.

United States Patent 4,031,655, issued June 28, 1977, entitled "Aerodynamic Sound-Emitting Amusement Device" discloses a flying saucer similar to the previous patent in having passages for air-flow from the lower to upper surfaces. Within the passages are located whistles which sound when the device is in flight. In one embodiment, the whistles are located in pimple-shaped protrusions on the upper surface, but such are not provided for aerodynamic purposes.

United States Patent 4,157,632, issued June 12, 1979, entitled "Aerial Toy" discloses dimples or raised ribs which "function as spoilers". The main feature of the claimed invention is the provision of a flying saucer having a periphery which is scalloped and provision for adding small weights to enhance the moment of inertia of the device.

United States Patent 4,216,611, issued August 12, 1980, entitled "Aerodynamic Toy" discloses a flying saucer having radially disposed ribs on the upper surface to act as spoilers.

All of the foregoing patents include structure which in one way or another defeat the primary and essential aerodynamic "cleanness" which is necessary for the maximum distance achieved after launching and the best possible stability.

It has been discovered, and verified by experimentation, that best performance is obtained from a circular flying saucer whose geometry, in cross-section, is defined by generally arcuate or part-elliptical curves, and wherein the device is relatively thin, in cross-section, adjacent the axis of rotation and relatively thick, in cross-section, adjacent the periphery thereof. Further, it has been found that the presence of elementary upwardly extending discrete spoilers on the upper surface of the saucer provides enhanced range and improved stability. Such spoilers are preferably, but not essentially, of hemispheric configuration and located at preferred positions on the upper surface of the flying saucer.

It is therefore a feature of the present invention to provide an amusement device in the form of a hand thrown, flying saucer, which device has enhanced range and improved stability. This improvement in range derives from three sources. Firstly, the upwardly extending (discrete) spoilers create a thin layer of turbulent air over the entire upper surface of the flying disc which then separates the surface of the disc and the laminar air flow and thereby reduces aerodynamic drag. Secondly, the small additional weight caused by placing raised (discrete) spoilers at or near the periphery of the flying disc causes a disproportionate increase in the angular momentum of the device which extends the duration of rotation. Thirdly, the concentric annular rings of discrete spoilers of various shapes are separated by equators of variable width which provide channels for a circumferential air flow. These channels provide "anti-roll" and "anti-slicing" capability which helps to extend flight times and distances even when the device is poorly thrown by a

novice practioner of this sport.

Empirical evidence of the above effects have been obtained using a prototype modified flying disc. Results are attached as Table 1. This shows that the modified ("pimpled") flying disc travelled further in the air than the unmodified flying disc in each of the six trials. Each launch was affected with the same angle relative to the horizontal and with the same momentum.

Each trial is made up of ten launches of each type of flying disc. Hence, the total number of launches in the six trials was 120 made up of 60 launches of the modified and 60 launches of the unmodified flying disc. Average wind speeds during each set of ten launches is also shown in the table.

For equal or near equal average wind speeds, the modified flying disc travelled between +10.6% and +20.6% further (trials 1, 2 and 3). In trial #4, the headwind was 40% greater on average during the launches of the modified flying disc which resulted in a reduced margin of +5.2%. Similarly, during the downwind launches (trials 5 and 6), tail winds were greater during the launches of the unmodified device with a reduction in the difference in performance. Nevertheless, the modified version still flew +7.8% further in both trials 5 and 6. It would seem reasonable then to expect performance increases of between 10% and 20% in terms of air distance travelled due to the modifications made to the flying disc.

A preferred embodiment of the invention will be described with reference to the following drawings, in which:

Figures 1 and 2 are histograms of the results of field trials.

Figure 3 is a plan view of one possible configuration of the modified flying disc and indicates one possible arrangement for the discrete spoilers and also shows a few streamlines;

Figure 4 is a cross-section of the disc shown in Figure 3 and also indicates deformation of the air stream;

Figures 5A, 5B, ..., 5E are isometric, plan and cross-sectional views of various spoiler shapes;

Figure 6 is a cross-sectional view of the disc shown in Figure 1 but it has attachable and detachable, discrete spoilers.

The differences in performance of the modified and unmodified flying discs can also be illustrated by the use of histograms. Figure 1 clearly shows the variation in performance in the upwind trials while Figure 2 shows the results of the downwind trials. Wind speeds are also indicated in these figures and should be taken into account when evaluating relative performance as noted above.

Referring now to Figure 3, there is shown a plan view of one version of the modified flying disc 30. Circular raised discrete spoilers 32 are arranged in three annular rings at or near the periphery of the disc. Each ring is made up of a plurality of hemispherically shaped raised "pimples" on the upper surface of the disc and spaced evenly around the circumference of each ring. The diameter of the discrete spoilers is shown to decrease along decreasing radii although spoilers of identical size or varying shape could be used for these purposes. Moreover, fewer than three or more than three rings of spoilers could be used. Indeed, the entire upper surface of the flying disc can be used for positioning annular rings although this has been found to add unnecessarily to the weight of the device without further improvement of range.

Still referring to Figure 3, the plan view of the device demonstrates that (in this version) at least one spoiler intersects any radius. The "staggering" of the spoilers in adjacent annular rings thus provides maximum disruption of the air flow along any radius. This provides a stable turbulent layer of air which acts as a "lubricant" between the surface of the disc and the laminar air flow further removed from the upper surface.

Referring to Figure 4, a cross-section of the device shown in Figure 3 demonstrates the presence of equators of

finite width separating each annular ring of spoilers. These equators (which can be of variable width) provide channels for air flow in a circumferential direction which improves the stability (and, hence, range) of the flying disc.

In Figure 4, the translation of the disc 30 in the air is as shown by the arrow 44. Thus, parallel stream-lines 40 first diverge near the rim of the flying disc, then approximate a stagnation point 42 so that some air flows over the top and some air flows beneath the disc 30. The spoilers 32 act as turbulators in the manner previously discussed.

Referring to Figures 5A-5E, a number of alternative shapes of spoilers are shown. These include: raised, curved spines of varying but finite length (5A); raised, hemispherically shaped "pimples" of varying diameter (5B); raised, cylindrical shaped "pimples" of varying diameter (5C); raised, rectangular or square shaped spoilers (5D); raised, star shaped spoilers (5E). Many other shapes of raised spoilers are possible but are not shown here.

It should be noted that the cross-sections of spoilers shown in 5A, 5C, 5D and 5E can be modified to include rounded edges or scalloped edges as in 5B.

Finally in Figure 6, detachable and interchangeable spoilers 60 can be accommodated and frictionally retained in associated recesses 62 disposed on the upper surface of the flying disc. That is, a user can experiment with different configurations using various sets of spoilers of different shapes and sizes.

Other embodiments falling within the terms of the appended claims will also occur to those skilled in the art.

TABLE 1: Test Trials for Comparison of Modified ("Pimpled") Flying Disc and Unmodified Flying Disc

CONDITION	TRIAL NO.	DIRECTION OF THROW	AVERAGE WIND SPEED[1]		AVERAGE DISTANCE TRAVELLED IN THE AIR[2]		PERCENTAGE CHANGE[4]
			Unmodified	Modified	Unmodified (X)	Modified[3] (Y)	
Headwind	# 1	Upwind	3.0	4.0	32.9	36.4	+10.6%
Headwind	# 2	Upwind	5.5	5.0	29.1	35.1	+20.6%
Headwind	# 3	Upwind	6.0	6.0	28.0	31.7	+13.2%
Headwind	# 4	Upwind	2.5	3.5	34.7	36.5	+ 5.2%
Tailwind	# 5	Downwind	5.5	3.0	34.6	37.3	+ 7.8%
Tailwind	# 6	Downwind	5.5	2.0	34.7	37.4	+ 7.8%

NOTES:

1. Speed in knots (nautical miles per hour).
2. Measured from repeated trials (ten per set) in yards.
3. Modified flying disc includes three annular rings of circular shaped (discrete) spoilers arranged in concentric rings at or near the periphery of device.
4. Percentage change equals [(Y-X)/(X)] * [100] %.

CLAIMS

1. A flying disc amusement device having a substantially flat central portion of substantially constant thickness and terminated by a rim portion of parallel-cylindrical configuration integrally joined to the flat central portion by a quarter-circle portion, said central portion having an upper surface upon which are disposed a plurality of raised and circumferentially spaced apart discrete spoilers of varying shapes or sizes, said spoilers being arranged in at least one circle concentrically disposed in relation to said rim.

2. The apparatus of Claim 1 wherein said raised, discrete spoilers are arranged in at least one annular ring on the upper surface of the disc.

3. The apparatus of Claim 1 wherein said raised, discrete spoilers are disposed at or near the periphery of the upper surface of the disc.

4. The apparatus of Claim 1 wherein said raised, discrete spoilers are arranged over the entire upper surface of the disc.

5. The apparatus of Claim 2 wherein the said at least one annular ring of raised, discrete spoilers is separated by finite equators of varying or equal width.

6. The apparatus of Claim 2 wherein said at least one annular ring contains raised, discrete spoilers of varying size or shape which are spaced at equal intervals around the 360° arc formed by the radius of said at least one ring.

7. The apparatus of Claim 2 including at least two concentrically disposed annular rings of discrete spoilers and wherein the position of raised, discrete spoilers in said at least two annular rings are staggered with respect to each other so that along any radii at least one spoiler is found.

8. The apparatus of Claim 2 wherein the dimensions of respective spoilers decreases with decreasing radius.

9. The apparatus of Claim 2 wherein the said at least one annular ring is arranged adjacent the periphery of the disc.

10. The apparatus of Claim 1 wherein the discrete spoilers are detachable and attachable and being of varying shapes and sizes and can be interchanged freely in sets or individually.

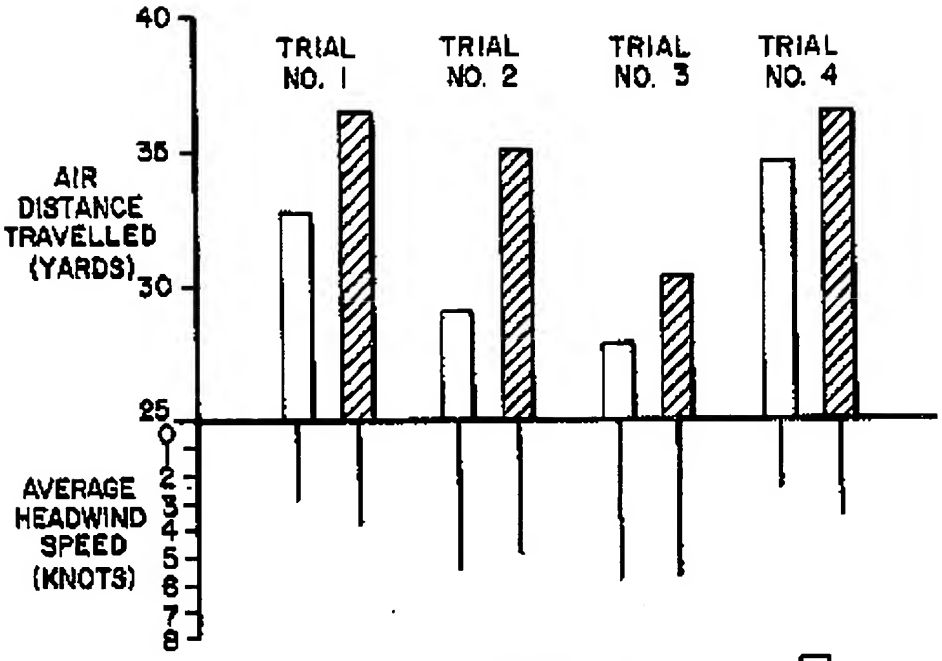
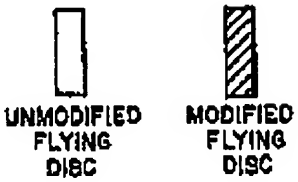


FIG. 1



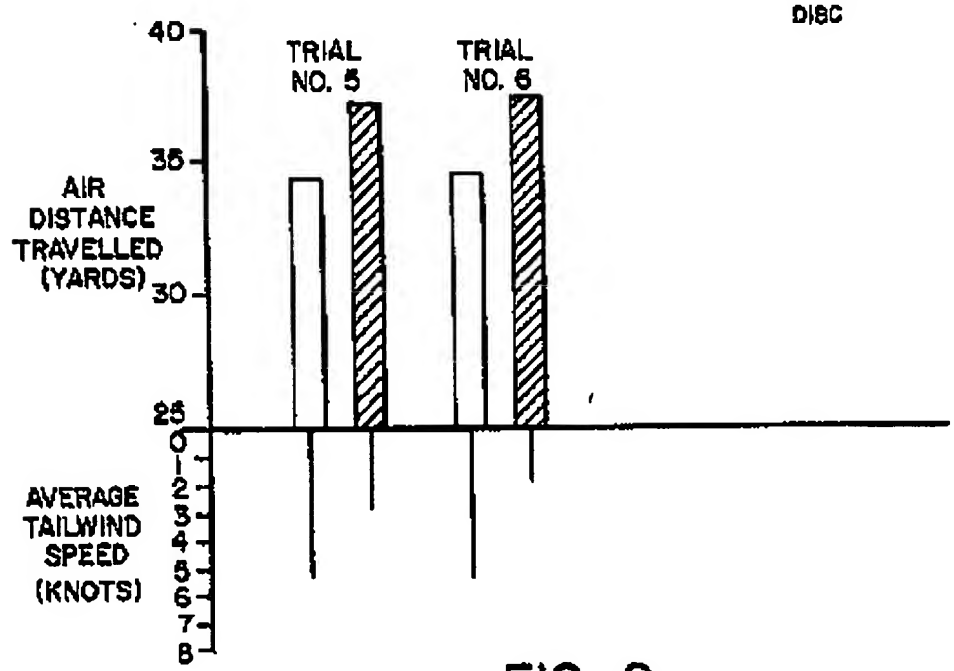


FIG. 2

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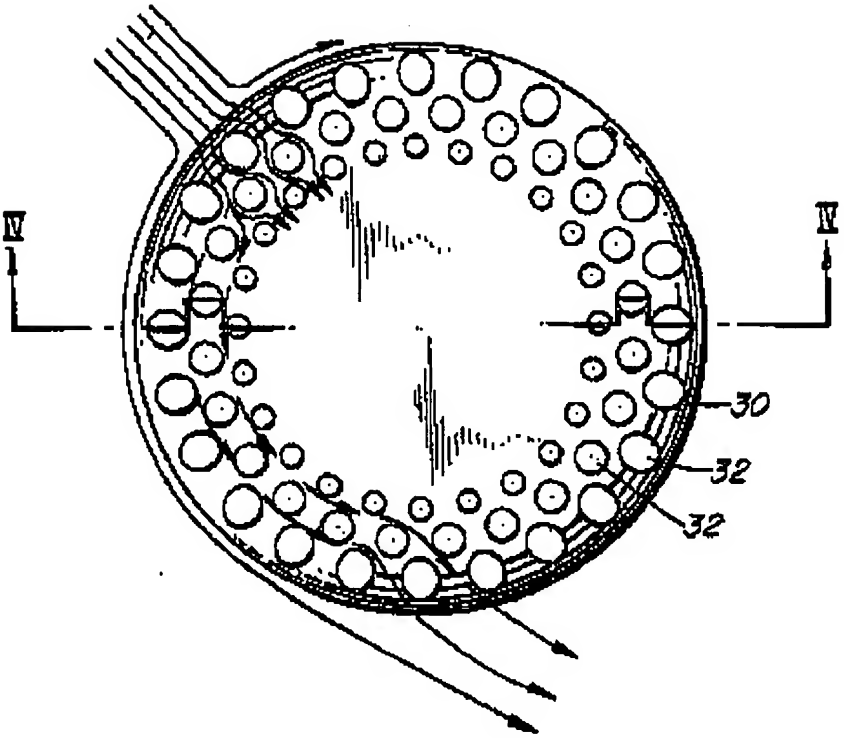

FIG. 3

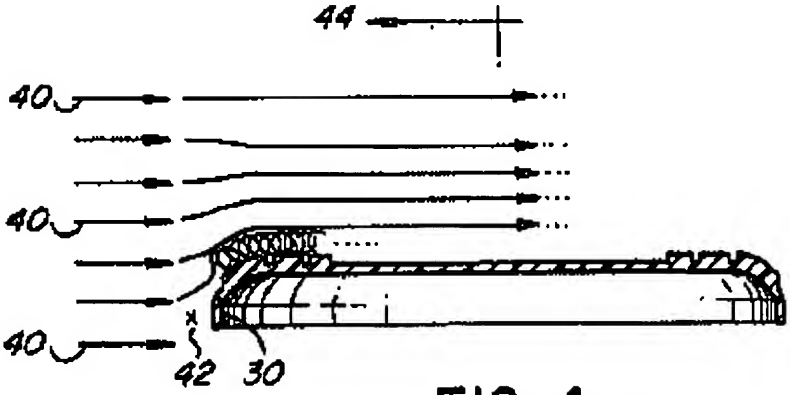

FIG. 4

FIG. 6

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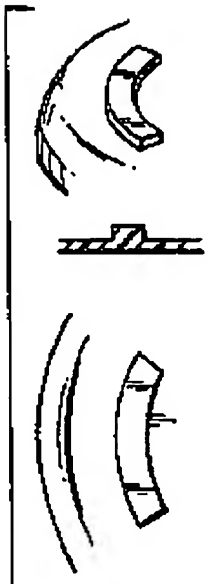

FIG. 5A

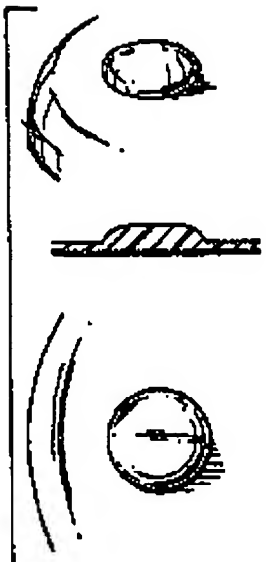

FIG. 5B

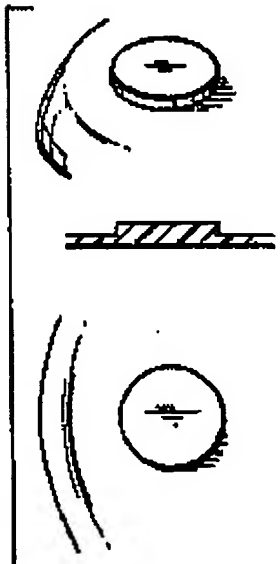

FIG. 5C

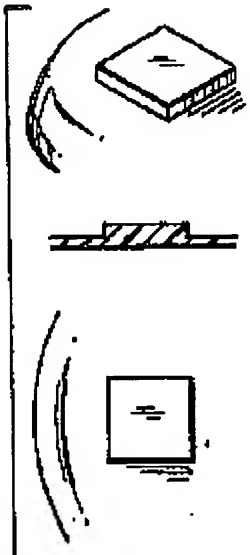

FIG. 5D

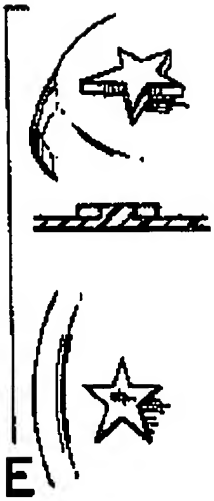

FIG. 5E

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